

GEO-stationary Coastal and Air Pollution Events (GEO-CAPE) 2013: Gulf of Mexico Cruise Report

Dates: September 9- 22, 2013



Vessel: R/V Pelican

Location: Gulf of Mexico

NASA FSG Participants: Antonio Mannino and Michael Novak (SSAI)

Chief Scientist: Antonio Mannino (NASA/GSFC)

Principle Investigators: Antonio Mannino (NASA/GSFC) Margaret Mulholland (ODU) Maria Tzortziou (UMD)

The GEOstationary Coastal and Air Pollution Events (GEO-CAPE) mission was recommended by the [NRC's Earth Science Decadal Survey](#) to measure tropospheric trace gases and aerosols and coastal ocean phytoplankton, water quality and biogeochemistry from geostationary orbit, providing multiple daily observations within the field of view. Multiple observations per day are required to explore the physical, chemical, and dynamical processes that determine tropospheric composition and air quality over spatial scales ranging from urban to continental, and over temporal scales ranging from diurnal to seasonal. Likewise, high frequency satellite observations are critical to studying and quantifying biological, chemical, and physical processes within the coastal ocean and beyond (<http://geo-cape.larc.nasa.gov/>)

The Ocean Ecology Laboratory's Field Support Group (FSG; code 616) participated on the Gulf of Mexico GEO-CAPE field campaign in September 2013 to complete work that was originally proposed by PIs Antonio Mannino and Maria Tzortziou. The GEO-CAPE field sampling built upon their previous work as well as supported two of the GEO-CAPE Ocean Science Tasks identified as of "High Priority" for FY2013:

Task 1-

"Apply observations of high temporal, high spatial or high spectral resolution data sets that have a rich set of associated observations, to 1. Short-term dynamics and 2. Algorithm development for coastal ocean products including non-standard products that are mission critical/highly desirable"

Task 2- "Exchanges across the land-ocean interface" that has been identified as particularly high priority in synergy with large field campaigns and existing/new observations. Better understanding short-term processes, land-ocean exchanges and impacts of human activities on coastal ecosystems and open ocean are major objectives of the GEO-CAPE mission

Antonio Mannino, Maria Tzortziou, and SSAI's Michael Novak flew to New Orleans, LA on September 7, picked up a rental vehicle and traveled to Cocodrie, LA where the Louisiana Marine Consortium (LUMCON) is located. The *R/V Pelican* was berthed at the facility and participants were able to have a look at the vessel that evening. The equipment that had been shipped was located and no further work was done that night.

Mobilization began the next morning and allocation of space began in the science labs for filtration apparatus and other scientific equipment. The crew and other scientists also assembled and prepared scientific instruments to be used on the cruise. Other institutions would be deploying Inherent Optical Properties (IOP) profiling packages as well as Apparent Optical Properties (AOP) profiling and above water packages. IOP instruments would also make continuous measurements from the flow-through system of the boat. Many of the optical instruments need to be mounted high on a mast or pole away from the boat's infrastructure to minimize shading effects. The crew decided that the best approach was to bolt a gangway to the port side of the 01 deck where the instruments could be mounted clear of sun obstructing objects (Picture 1). At the end of the day this task was still not completed.

Set up operations recommenced on the morning of September 9, and by the afternoon the

gangway was safely secured to the ship and the instruments were mounted. All the other equipment was secured or stowed away and the ship left port at approximately 1400 local time. The *Pelican* arrived at the wavecis AERONET station at 1630 local time and began water sampling and collecting profile data. The first station was a good “shakedown” and allowed weaknesses and strengths in sampling strategy to be identified and dealt with. After the station was complete, the boat steamed back inshore towards the Mississippi River. A drifter drogue was release at about 01:00 local time within the river plume.

On the morning of Day 2, the ship began a Mississippi plume transect starting offshore southwest of the river and heading towards the outflow. Instrument profiles were collected at seven stations and discrete samples were collected at multiple depths at six of those stations. The drogue was recovered at the end of the day and the boat steamed up the Mississippi river to collect a freshwater end member sample. The ship approached Pilottown, LA and a sample was collected from the flow-through system at about 0.79 PSU at 01:12 local.

At the first station on Day 3, the drogue drifter was redeployed in the Mississippi River plume several miles from the shore south of the southwest pass. The drogue was tracked throughout the day and profile data and discrete measurements were collected every two hours for a total of seven stations. During the night the *Pelican* steamed towards Marsh Island State Wildlife refuge near Vermillion Bay.

The ship’s safe boat was deployed on Day 4 to collect samples near Marsh Island and its adjacent bays. Sea state conditions proved to be difficult due to the approaching swell from Hurricane Ingrid in the southwestern Gulf near Mexico. The safe boat was able to collect water from five stations. The *Pelican* acted as its own drifter that day and profiles and water were collected about every two hours. A total of six profile stations were sampled.

On Day 5 (September 13), the drifter drogue was deployed and tracked in relatively clear water southwest of Marshall Island. The filamentous cyanobacteria, *Trichodesmium sp.* could be seen with the naked eye in the water column. A total of six stations were carried out approximately every two hours. During the night the *Pelican* traveled back inshore to the west of Marshall Island.

On Day 6, the ship began a two day transect from the coast heading offshore on a south west bearing. Six full stations were sampled during the day and two IOP casts were done in the night.

The first station on Day 7 was the furthest offshore from the transect and in very clear water. Six more full stations were sampled on the way back in shore on a northwest heading towards Galveston Bay, TX.

On Day 8, (September 16) the drogue was deployed south of Galveston Bay about 6 miles from the coast. The ship followed the drifter to the southwest and sampled surface and only one depth at 4 stations. The safe boat was also deployed and five stations were sampled in and around Galveston Bay. Additional samples were collected for Harmful Algal Blooms (HAB) in this region. Two IOP casts were collected in the evening while following the drifter and the drogue. The drifter was recovered at approximately 21:00 local time and the boat steamed through the

night back towards the coast.

On Day 9 the *Pelican* began a transect to the east of Galveston Bay along the coast to the Sabine River. Six complete profile stations were sampled as was one IOP cast and flow-through station at the end of the day. The King Air research aircraft flew over the ship's location on this day.

On Day 10 (September 18), the *Pelican* entered Galveston Bay and the safe boat was deployed. The *Pelican* could only steam within the channel. Two profile stations were carried out while transiting up into the bay and then the boat dropped anchor just outside the channel in shallow water. Surface samples were collected with the rosette while moored about every two hours (three times). The flow-through system was shut down to avoid sediment uptake into the system.

On Day 11 a spatial-temporal survey was conducted along a repeat cruise track that was a five by five kilometer box. A total of six full profile stations were sampled. During the evening the ship transited a bloom region in the south east that was identified from satellite observations.

At approximately 07:00 local time on September 20 (Day 12), the *Pelican* deployed the drogue in offshore waters where a bloom was expected and followed it for the rest of the day. Six full profile stations were completed throughout the course of the day. At about 19:00 local time an IOP cast was completed and then the drifter was recovered. The ship steamed through the night towards the coast on a northerly track.

On September 21 (Day 13) the *Pelican* began another transect heading North from near-offshore waters towards Marsh Island and then turned east towards the Atchafalaya River. A total of six profile stations were sampled, but the last station only had one discrete surface measurement because the bottom was at less than five meters. There were heavy rains for most of the day, so the AOP profiling optical instruments were only deployed at the last two stations when the rain let up. In the evening the ship headed back offshore again.

On the final day of the cruise (Day 14 – September 22), the *Pelican* began to steam back towards Cocodrie, La. A four station northeasterly transect was conducted from near-offshore waters towards Terrebonne Bay. Once inside the bay, the flow-through system was shut down and demobilization of the instruments and scientific equipment began. The ship arrived at the dock at approximately 1600 local time and participants worked through the evening breaking down and unloading gear.

The *Pelican* was equipped with a CTD rosette package and discrete measurements were made at multiple depths using Niskin bottles. A total of 227 discrete samples were collected for CDOM and DOC analysis. 226 discrete depths were sampled for HPLC, POC, and a_p . TSM was only collected at the surface for a total of 103 discrete samples. All of these variables will be measured, processed, and quality controlled by the Field Support Group.

TABLES, FIGURES and PHOTOGRAPHS

Table 1: Biogeochemical parameters collected on the GEO-CAPE cruise September 2013.

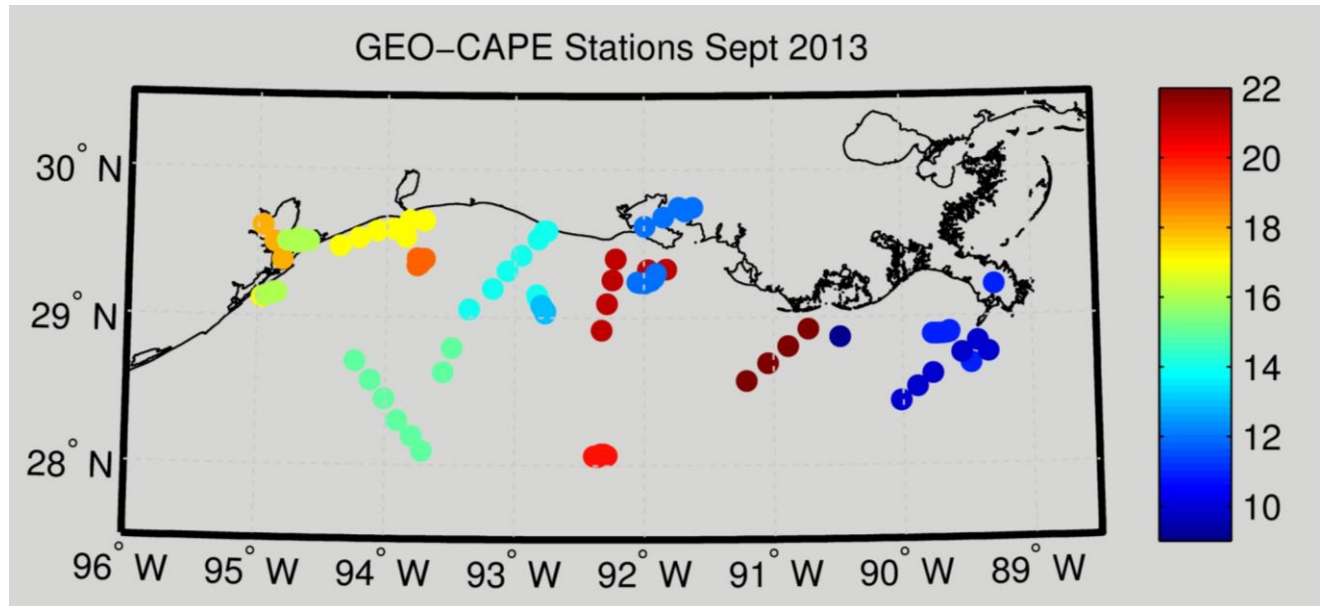
Parameter	Number of discrete samples collected	# of reps collected
HPLC Pigments	226	Duplicate at all depths
a_p	226	Duplicate at all depths
POC	226	Triplicate at Surface Duplicate at depth
a_{CDOM}	227	No reps
DOC	227	Triplicate at Surface Duplicate at depth

Figure 1:

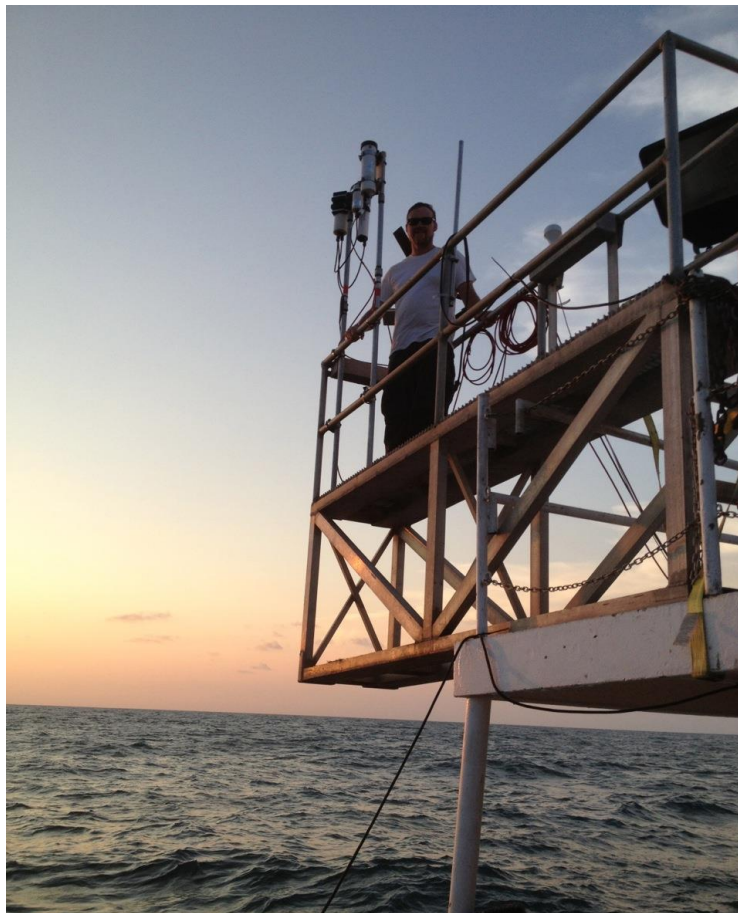


Station Locations.

Figure 2. Stations represented with the color bar by day in September



Picture 1- Instruments on gangway



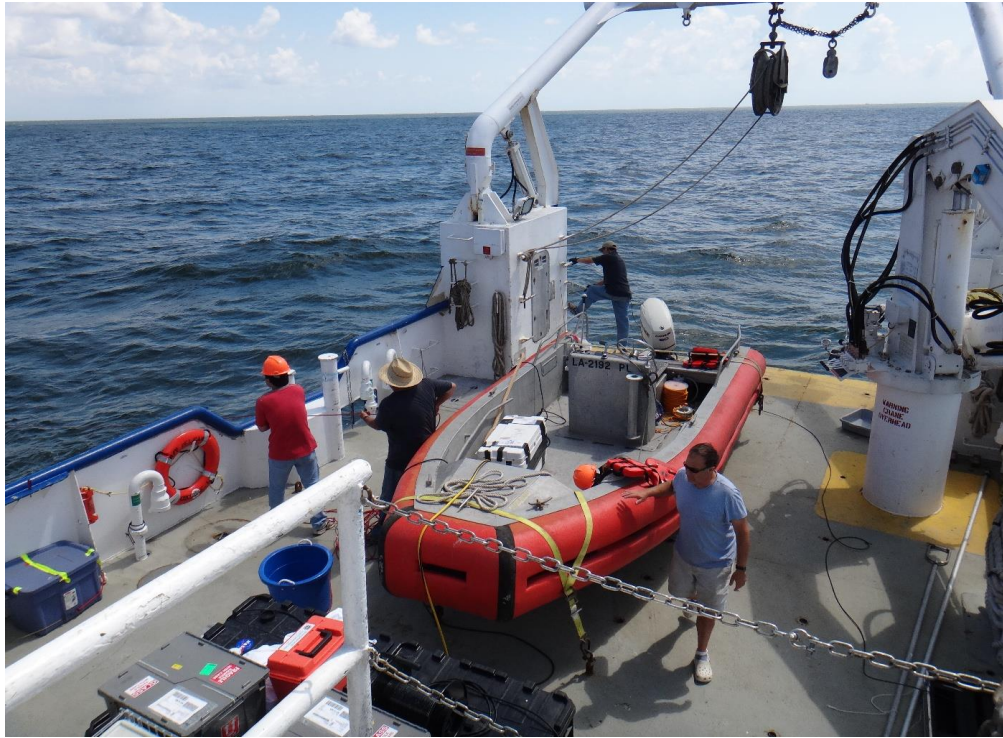
Picture 2. Different angle of Gangway



Picture 3. Preparing Rosette for Deployment



Picture 4. Safe Boat used for small boat operations



Picture 5 Wetlab on the Pelican



Picture 6. Deploying the Hyperpro AOP package

